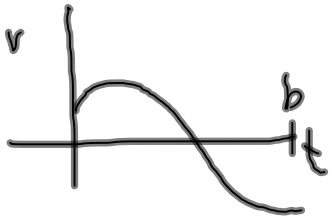
# 7.1 Integral as net change


$\int_0^3 v(t)\,dt = 180$ mi ← distance




$\int_0^b v(t)\,dt = 0$ displacement

distance from starting point

final position = displacement + initial position

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$\int_a^b \text{rate}\,dt = \text{net change}$

$\int_a^b \underbrace{\text{acceleration}}_{\text{rate of change of velocity}}\,dt = \text{net change in velocity}$

$a = 2.4t$ mph/sec

$v_0 = 5$ mph

a) $v_f$ when $t = 8$ sec

b) How far does it go?

$\int_0^8 2.4t\,dt + 5$

$1.2t^2\Big|_0^8 + 5$

$1.2 \cdot 8^2 + 5$

$76.8 + 5 = 81.8$ mph

$\int_0^8 1.2t^2 + 5\,dt$

$\frac{1.2t^3}{3} + 5t\Big|_0^8 = 244.8$ mph·sec

$= 244.8 \frac{\text{mi}}{\text{hr}} \cdot \text{sec}$

$= 244.8 \frac{\text{m}}{\text{hr}} \cdot \frac{\text{sec}}{3600\,\text{sec}}$

$= .068$ mi

$a = 2.4t$

$v = 1.2t^2 + C$

$5 = 1.2 \cdot 0^2 + C$

$v = 1.2t^2 + 5$

t in sec


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Ex 5 Potato consumption $C = 2.2 + 1.1^t$ ← rate of change of consumption

$t$ - yrs since beg of 1970

$C$ = Mbu/year


How many bushels consumed from beg 72 to end of 73?

$$\int_2^4 2.2 + 1.1^t \, dt = 7.066 \text{ Mbu}$$

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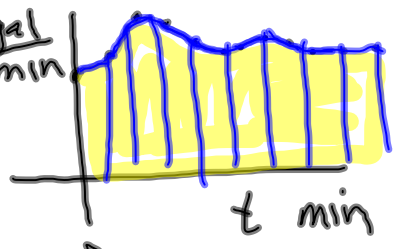
Ex 6

How much water was pumped during this hour?

use Traps

| time | rate gal/min |
|---|---|
| 0 | 58 |
| 5 | 60 |
| 10 | 65 |
| 15 | 64 |
| ⋮ | ⋮ |
| 55 | 63 |
| 60 | 63 |




$\frac{h}{2}[y_0 + 2y_1 + 2y_2 \cdots + y_n]$

$h = 5$

$\frac{5}{2}[58 + 2 \cdot 60 + 2 \cdot 65 \cdots] = 3587.5$ gal

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